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From President's Desk

From Starch to Protein Security

The realization to build a robust and self reliant food security took shape in form of a concerted national effort integrating agricultural research and development that resulted in transforming agricultural scenario, termed as Green Revolution. The developments brought about reasonable degree of food security but achieving household nutritional security through a balanced diet remained elusive.

As per the FAO, food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. A large percentage of our population remains malnourished with major share of nutrition coming from cereals, mainly rice and wheat. About 795 million people are undernourished globally and as per the FAO State of Food Insecurity in the World (2014); more than 190 million people are undernourished in India.

Following the success of Green Revolution, the concerns of malnutrition and hidden hunger were to be addressed. In this endeavour, R&D priority was accorded to diversify the food basket by including non-cereal food items. Consequently, the productivity, production and availability of fruits, vegetables, milk, meat, eggs and fish started increasing, as a result the share of cereals in the average diet started declining. The diet became nutritionally balanced with more of protein and less of starch. The per capita shift in availability of food-grains and items of food from 1951 to 2014 is tabulated below:

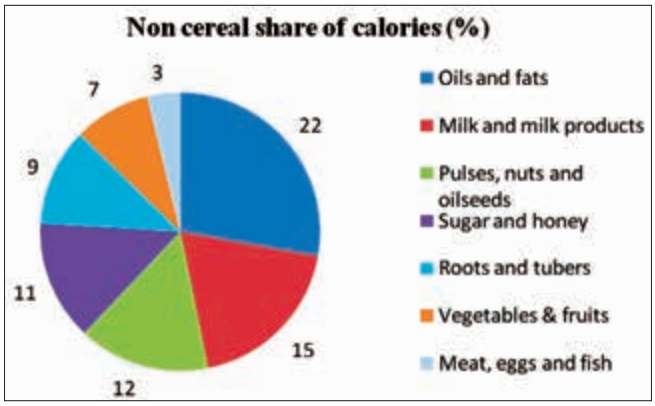
Per capita availability of major food items

Commodity	1951	2014
Foodgrains	144.1 kg/year	186.4 kg/year
Rice	58.0 kg/year	84.8 kg/year
Wheat	24 kg/year	66.9 kg/year
Pulses	22.1 kg/year	15.3 kg/year

Commodity	1951	2014
Edible Oil	3.8 kg/year (1980-81)	15.8 kg/year
Milk	139 gm/day	307 gm/day
Meat (1960)	3.7 kg/year	5.5 kg/year
Eggs	5/year	61/year
Fish		0.269 (Rural) 0.238 (urban) kg/capita/month
Fruits		200 g/person/day
Vegetables		365 g/person/day

Source: Reports of Ministry of Agriculture and Farmers Welfare, GOI.

The National Sample Survey Office's (NSSO) 2011-12 report on Nutritional Intake reveals dietary energy intake per person per day as 2233 Kcal for rural India and 2206 Kcal for urban India. All the major States had per capita rural/urban levels of calorie intake within 11% (plus or minus) of the all-India rural/urban average. Both numbers are still below the recommended norm of 2,400 Kcal/person/day. The cereals account for a major share, 57% of the calories while non-cereal foods contributed about 43% of calorie intake in an average Indian diet. The percentage break-up of this part of non-cereal calorie intake is shown in the figure.



At the all-India level protein intake per person per day is about 60.0 gm. The share of cereals in protein intake was 58% for rural and 49% for urban India. The share of meat, fish and egg in protein intake was only 7% in rural India and 9% in urban India. Some foods contain high amounts of protein and can be classified as protein-rich foods, such as meat, fish and egg, and plant foods like pulses, oilseeds and nuts. These foods contain over 20% protein and soybean is the richest source containing over 40% of protein. Cereals are a moderate source of protein as they contain about 10% protein. Rice contains less protein (7%) than wheat (approximately 10%) and other cereals. Calorie and protein source in the Indian diet is diversifying with fruit/vegetable and animal-based food share increasing and cereal and pulses declining.

In order to achieve the much desired household nutritional security, without resorting to imports, we need to enhance farm productivity, explore avenues to diversify agriculture, increase area of pulse cultivation and develop bio-fortified varieties/breeds with enhanced nutritional content in the product of consumption besides being resilient to climate change and fit well into farming systems that the farmers adopt. Simultaneously, efforts are needed to lay emphasis on post harvest processing, product development and value addition of the farm produce. This calls for a shift in research, technology generation and dissemination, and commercialization along with capacity building in frontier areas of research. Therefore, for any effort to fight hunger and malnutrition, we need a 'protein revolution' in the country that will necessarily come with a change from starch based food towards a diet with higher component of non-cereal protein rich food.

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Workshop on 'State of Indian Agriculture: Soil' (Convener: Dr. Himanshu Pathak)

The United Nations have declared the Year 2015 as the **"International Year of Soil"** to increase awareness and understanding of the importance of soil for food security and essential ecosystem functions. Realizing the importance of soil health for sustainable food and nutritional security and its relevance to Indian Agriculture, the National Academy of Agricultural Sciences decided to celebrate this important event by bringing out a publication on ***'State of Indian Agriculture: Soil'.*** As a prologue to the publication, a Workshop was organized on August 21, 2015 at NAAS, New Delhi to identify (a) the scope and objectives of the publication, (b) identify the

Chapters and authors, and (c) develop an outline of the Chapters. The Workshop was attended by more than 30 eminent experts and scientists. There were 15 presentations and each presentation was followed by a lively discussion. The Workshop was chaired by Prof. R.B. Singh, Immediate Past President, NAAS. He highlighted the importance of soil for sustainable food and nutritional security. He observed that Indian agriculture is at the cross-roads and improved soil management is crucial for improving productivity. It was suggested that the soil-water-plant-animal-human-atmosphere continuum should be highlighted in this publication and soil should not be discussed in isolation. It was emphasized that the Academy should focus on the importance of land use and soil health card to lend support and in turn enable the programs of the Government to be more effective and efficient.

Issues and Challenges in Shifting Cultivation and its Relevance in the Present Context (Conveners: Dr K.M. Bujarbaruah and Dr U.C. Sharma)

This Brainstorming Session was organized on August 17, 2015 by NAAS at New Delhi. It was chaired by Prof. R.B. Singh, immediate past president, NAAS and co-chaired by Dr. S.P. Ghosh, former DDG, (Horticulture). Ten thematic presentations were made by eminent experts from across the country. After detailed

deliberations the following important recommendations were made: (i) research on social component is critical in understanding and managing shifting cultivation; (ii) imparting value addition to local forest and agriculture produce including value chain analysis; (iii) harnessing potential of local plants including microorganisms for medicinal and ornamental use; (iv) preparation of ecosystem based carbon balance to be linked to future carbon credit/trading; (v) make efforts to strengthen data-base and identification of potential areas for technology intervention; (vi) documentation and validation of traditional knowledge of Jhumias; (vii) replication of success stories including identification of climate analogues. At the end, Prof. R.B. Singh made valuable suggestions for improving the base paper in the light of discussions and above recommendations. He specifically laid emphasis on bringing out policy inputs for involving youth, improvements in land-use and land-tenure system with specific reference to the north-eastern India.

Integration of Medicinal and Aromatic Crop Cultivation and Value Chain Management for Small Farmers (Convener: Dr. A.K. Tripathi and Dr. E.V.S. Prakasa Rao, Co-Convener)

A Brainstorming Session was organized by NAAS, New Delhi on August 18, 2015. The discussions were focused

on the current status of Medicinal and Aromatic Plants (MAPs), cultivation of MAPs in different agro-climatic regions, cropping systems and problem soils, and industry-research-farmer linkages in MAPs. Support programmes of Ministry of AYUSH and promotional activities of Spices Board, Ministry of Commerce were also discussed. Farmers' views were also presented by progressive farmers from Uttar Pradesh and Tamil Nadu. The following recommendations and action points emerged from the discussions.

- Bio-diversity hot spots of MAPs require to be mapped in order to understand strengths and opportunities in MAPs sector.
- Medicinal and Aromatic Crops (MACs) need to be positioned for synergy with food, nutrition, income and health.
- The current poor share of India for herbals in global markets need to be improved.
- Successful pilot studies involving MAPs cultivation, processing and marketing need to be documented; up-scaled and out scaled. Success stories of contract farming methodologies need replication at different agro-climatic conditions. APMC models may be harnessed for marketing of MAPs.
- MACs may be considered as suitable crops for cultivation on waste lands.
- Demand-supply analysis, value chain management, market intelligence, etc. in MAPs sector requires to be researched; production of health foods, organic products, etc. need attention to enhance returns to farmers.
- Availability and supply of authentic and elite planting materials needs to be augmented.
- Aromatic and medicinal plants should be treated separately for evolving suitable strategies. Separate entity of government support for aromatic crops is needed.
- There is a need to strengthen human resources for research using modern tools of biotechnology for technology development in MAPs sector.

Augmenting Forage Resources in Rural India: Policy Issues and Strategies (Convener: Dr. P.K. Ghosh)

A Brainstorming Session was organized by NAAS, New Delhi, on September 08, 2015.

Dr. Panjab Singh, Former Secretary, DARE and Director, General, ICAR, New Delhi chaired the session. About 35 participants from difference organizations and institutes, including two progressive farmers participated in Brainstorming.

Dr. M.P. Yadav, Secretary, NAAS, in his remarks highlighted the urgent need for augmenting forage resources at village level leading to improvement in livestock productivity and resource poor farmer's income/livelihood. Dr. P.K. Ghosh gave an overview on 'Present status of forage resources in rural India and the need for policy issues and appropriate strategies for its improvement'. Other experts made presentations on different aspects like (a) Grasslands as forage resources in India: need for enabling policies; (b) Strategies for meeting the fodder needs of small farmers; (c) Forest forage resources: policy and strategies in the state of Madhya Pradesh; and (d) Forage seed chain strengthening: conceivable way out. After detailed deliberations it was recommended that there is need for enabling policies on following aspects.

- **Judicious use of available crop residues:** Policy guidelines to prevent the burning of crop residues in fields need to be outlined. Similarly, diversion of edible crop residues towards packaging industry and bio-fuel production needs to be checked.
- **Allowing grazing or harvesting of forage resources from forests:** A synergistic approach between the forestry and livestock departments needs to be adopted for the controlled use of grasses in forest margin, which supply a considerable quantity of forages for our livestock.

- **National grazing-cum-fodder and pasture management policy:** It should address issues pertaining to diversion of grazing lands for other purposes, conversion of critical grassland habitats into plantations, research on grassland ecology and pasture management, capacity building of managers and resource users, rehabilitation of degraded grazing lands, collaborative management of grazing lands and fodder resources with local communities.
- **Insurance and minimum support price for fodder crops:** Fodder crop should get a central place within the various agro-ecosystems and be treated at par with the facilities provided to agricultural crops like crop insurance, minimum support price (with the concept of fodder bank) and similar other benefits.

Besides the above mentioned policy improvements, following action points were recommended for consideration and implementation at appropriate levels:

Area-based approach for cultivated green forage production; Rejuvenation of grazing lands/common property resources; Promoting forage production from problem soils/wastelands; Addressing the issues of fodder seed production; Monitoring the availability of forages from forests; Promoting fodder species under agro-forestry initiatives; Integrating forage production with food and other crops; Promoting area/situation specific hydroponic green fodder production; Promoting the forage bank concept of preserving surplus production from rangelands during rainy season; Monitoring peri-urban fodder production and dairying/ livestock farming; Creation of real data-base on fodder resources; Establishing a national centre of excellence (CoE) for fodder and pasture development.

At the close of deliberations, Prof. R.B. Singh, Immediate Past President of NAAS, New Delhi remarked that in order to achieve sustainable development goal, we should keep in view soil-plant-animal-human chain/ interfaces based on agro-ecosystems like hill, arid, semi-arid, etc. Forage resource management should be based on demand driven / innovations including climate smart fodder and livestock production in near future.

Strategy for Future of GM Crops in India (Convener: Dr. K.V. Prabhu)

A brainstorming discussion was held at NAAS on September 29, 2015. The programme was chaired by Prof. M.S. Swaminathan, Founder-Honorary Chairman, MSSRF, Chennai and Co-chaired by Dr. R.S. Paroda, Chairman, TAAS, New Delhi. Dr. S. Ayyappan, Secretary DARE & D.G. ICAR and President NAAS extended floral welcome to both Chair and Co-Chair and thanked all

the esteemed experts and Fellowship of the Academy for participating in this important meeting. Dr. Manju Sharma, former Secretary DBT and Dr. Deepak Pental, former Vice-Chancellor, Delhi University and the Vice Presidents of Academy Prof. P.L. Gautam and Prof. Anupam Varma were among the participants. Dr. Ayyappan at the start informed the Chair and Co-Chair the progress made at ICAR and NAAS to pursue the issues relating to confined field trials and release of GM crops at the highest level in the country, the Prime Minister. He informed that the Honourable Prime Minister of India has sought further clarifications on the proposal and road-map for taking the GM crop technology forward justifiably and take up problem-solving research in the country. It was unanimously agreed to provide appropriate additional information and strategies arrived at, in the brainstorming session to the Honourable Prime Minister for his kind consideration. Prof. Swaminathan in his opening remarks mentioned that several discussions have been held on the issues related to GM crops technology and its relevance in India. There has to be action initiated to move forward. Since all our science endeavours are for public good, it is necessary that more scientific information was made available to the public and political classes on this issue than that is available at the moment. Dr. R.S. Paroda shared detailed information provided under the signatures of 50 prominent agricultural scientists led by Prof. Swaminathan in 2014, which has been considered by the Honourable Prime Minister for action by the Ministry of Environment, Forests and Climate Change for promoting GM crops/technology following all safety regulations in the country in specific areas to solve the problems of farmers and food security issues. After these brief remarks by the Chair and Co-Chair, Dr. Prabhu made a detailed presentation highlighting the GM crop situation in India, the regulation, technology generated, status and the future strategies required for the benefit of the technologies to reach the farmers. The need for facilitation of field trials, smoothening the implementation, creation of facilities, investment needed,

and the existing problems of the requirement of 'No Objection Certificate' from State Governments before conduct of trials etc. were discussed. A suggestion was made for developing 'Biology Document" for identified crops in which research was already on. The issues related to facilitating the confined field trials and having these carried out through ICAR's participation in designated trial sites, which in turn were to be supported by the Govt. of India for infrastructure and capacity building within NARS etc. were deliberated in depth. At the end of deliberations it was concluded by Prof. Swaminathan that in addition to the seven points already listed in the communication sent earlier to the Honourable Prime Minister, the other points taken as output from this discussion, to be included in the follow up to the Prime Minister were the convergence of acting points among Ministries of Agriculture, Science and Technology, Environment, Forest and Climate Change and ICMR; setting up of testing facilities and mechanism for bio-safety assessment under public sector; development of a strong mechanism for creating more awareness about GM crops/technology among public and political class; interaction of involved scientists with other scientists, and development of popular literature on GM crops technology in regional languages. It was suggested that wherever feasible NAAS should support it academically. The meeting ended with a formal vote of thanks proposed by Prof. P.L. Gautam, Vice-President, NAAS.

Practical and Affordable Approaches for Precision Farming Equipment and Machinery (Convener; Dr K.K. Singh, Co-conveners: Dr. S.R. Verma & Dr. G.S. Manes)

The Brainstorming Session was organized on 30th September, 2015 at NAAS, New Delhi. It was attended by eminent scientists from the ICAR institutes, SAUs, DoAC, CIMMYT, and Fellows of the academy. The Session was inaugurated by Prof. P.L. Gautam, Vice-President, NAAS. He in his remarks highlighted the importance of the topic and expectations of NAAS from the session with policy paper as output. The session was chaired by Dr. A. Alam, Former, Vice Chancellor, SKUAST, Srinagar. Dr. S.R. Verma,

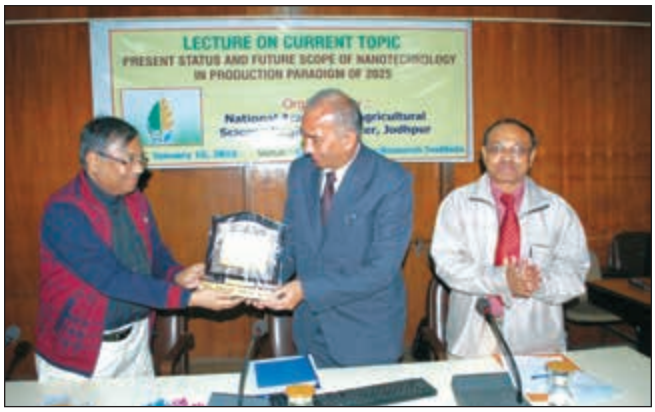
Former Dean, College of Agricultural Engineering, Punjab Agricultural University, Ludhiana briefed about the background of the base paper with main focus on enhancement and promotion of the policies related to precision in existing farm equipment and machinery. Dr. K.K. Singh, Convener & Director, CIAE, Bhopal presented the concept of precision index for different farm equipment and machinery and need for promotion of precision farm equipment. Prof. B S Pathak, Dr. N S.L. Srivastava, Dr. K. Alugusundaram, DDG (Engg.), Dr. M.L. Jat and other eminent scientists provided valuable inputs. After detailed deliberations following major recommendations emerged:

- Promote use of precision farm equipment like laser guided land leveller, pneumatic planter, drip irrigation system, air assisted sprayers.
- Manufacturer must provide part's catalogue and operator's manual with every equipment to ensure proper adjustment, calibration and maintenance.
- Ensure specified tolerances, fits, limits during manufacturing of standard components and farm equipment.
- Provide interchangeable components of standard design on all farm equipment and machinery.
- Develop/revise National and International standards for critical components and precision farm equipment.
- Provide additional incentives to farmers for use of precision farm equipment and machinery to enhance input use efficiency.

Activities of Regional Chapters

Jodhpur

The Jodhpur Chapter of the National Academy of Agricultural Sciences organised a guest lecture on "*Present Status and Future scope of Nanotechnology in Production Paradigm of 2015*" on 16 January 2015 at Central Arid Zone Research Institute, Jodhpur. The lecture was delivered by Dr. S.R. Vadera, Director, Defence Research and Development Organization, Jodhpur. The lecture was attended by the scientists of CAZRI and NAAS Fellows of that region. The lecture



was focused on understanding and control of matter in the nanoscale, its scope and applications under different fields of research with special reference to agriculture and defence.

Dr. J.C. Tarafdar
Convenor, Jodhpur Chapter

Ludhiana

A Special Lecture was organized by the Ludhiana chapter of NAAS at Farmer Service Centre of PAU on 10 June 2015. It was delivered by Dr. S.K. Dash, Prof. and Head, Department of Agricultural Processing and Food Engineering, Orissa University

of Agricultural Science and Technology, Bhubaneswar, on **"Packaging and its vital role in extending the shelf life of food products and waste reduction"**. Dr. Baldev Singh Dhillon, Vice Chancellor, Punjab Agricultural University, Ludhiana and Convener of Ludhiana Chapter chaired the session. Dr. A.S. Nanda, Vice-Chancellor, Guru Angad Dev Veterinary and Animal Science University, Ludhiana (GADVASU) graced the occasion. The lecture was attended by NAAS Fellows and faculty from PAU and GADVASU.

Dr. S.K. Dash, in his lecture discussed different types of packaging, namely smart packaging like active and intelligent packaging, controlled atmosphere packaging, modified atmosphere packaging and vacuum packaging. In active packaging he highlighted various techniques like oxygen scavengers, carbon dioxide scavengers and ethylene scavengers, odour and flavor absorbers and releasers, moisture absorbers, and antimicrobial packaging involving use of organic acids. He mentioned that silica gel, activated clay, minerals and calcium oxide are mainly used as moisture absorbers. He informed the house that intelligent packaging is tracking the food item and communicating to consumers about health and safety of packed food through sensors, indicators and RFID tags. Types of sensors and indicators discussed were time temperature indicator, microbial growth indicator, physical shock indicator and leakage indicator.

Dr. Dash outlined research opportunities in the field of smart packaging including active packaging and studying the effect of active packaging on microbial ecology and food safety.

Dr. A.S. Nanda, in his concluding remarks appreciated the enlightening lecture of Dr. Dash and emphasized on adoption of packaging technologies.

On this occasion Dr. Dash was felicitated by Dr. B.S. Dhillon, Vice Chancellor, PAU.

Dr. B.S. Dhillon
Convener, Ludhiana Chapter

Kochi

During the fourth NICRA Workshop held at CMFRI, Kochi, a meeting of the NAAS fellows was held on 13 August 2015 at the facility allotted to the NAAS Kochi Regional Chapter. The meeting was attended by Dr. S. Ayyappan, President of the Academy, Dr. S.M. Virmani, Foreign Secretary, NAAS, Dr. B. Venkateswarlu, Dr. A.K. Singh, Dr. P.K. Aggarwal,

Dr. K.K. Vass, Dr. B. Mohan Kumar, Dr. C. Srinivasa Rao, Dr. C.S. Ravishankar, and Dr. K.V. Peter. Dr. A. Gopalakrishnan, Convener, Kochi Regional Chapter and Dr. T.K. Srinivasa Gopal, Treasurer, Regional Chapter were also present.

Dr. A. Gopalakrishnan
Convener, Kochi Chapter

93rd Meeting of Executive Council

The 93rd meeting of the Executive Council of the National Academy of Agricultural Sciences (NAAS) was held on 19 September 2015. The meeting was chaired by Dr. S. Ayyappan, President, NAAS, Secretary, DARE and Director General, ICAR. It was attended by EC Members including Prof. R.B. Singh, Immediate Past President, Vice-presidents, Prof. Anupam Varma and Prof. P.L. Gautam and Conveners of Sectional Committees. The recommendations of the Sectional Committees and the Convener's Group for finalization of Academy Fellowships/ Associateships for the year 2016 were presented by Prof. P.L. Gautam, Chairman of the Conveners' Group and endorsed by EC. Prof. P.L. Gautam presented the action taken report and also the progress in implementation of the academy programmes. He also informed the house that for the year 2016, the proposals received for the brainstorming from the Fellows were also examined by the programme committee and some changes in the format have been proposed. Accordingly for the year 2016, five broad themes areas viz. (a) abiotic stress (including drought, flood and hail storm) management; (b) food and nutritional secure India by 2030; (c) initiatives and innovations for farmers welfare; (d) revisiting national and state legislative instruments and policies impacting agricultural development; (e) capacity building and preparedness for international negotiations, were approved. This decision was in line with the recommendation of the Committee constituted to assess the Impact Assessment of NAAS Policy Papers.

The EC decided that the Academy should strongly propose the name of Professor M.S. Swaminathan to the Government of India for consideration of awarding Bharat Ratna title to him.

It was also decided that on 27 November 2015 a one-day programme to commemorate the Golden Jubilee of Green Revolution in India will be organized jointly by NAAS, ICAR and IARI at IARI, New Delhi. The programme for the day was discussed and finalized.

The agenda regarding translating some selected policy papers in regional languages by Regional Chapters and SAUs was discussed by EC and it was decided that translated version should also include a Disclaimer that the NAAS would not be responsible for any distortion of facts of science that might have crept in because of the translation in regional language.

Outreaching the Water Management Research in India

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The National Water Policy (2012) aims to improve the present water use efficiency by 20% (GOI, 2008). In this context, the Indian Council of Agricultural Research (ICAR) has taken up the implementation of various water management schemes in different regions of the country for the past four decades through All India Coordinated Research Program (AICRP) on Water Management and Groundwater Utilization schemes. These schemes aim to promote water resource use efficiency and achieve more crop produce and income per drop of water. The concept of "more crop per drop" has now gained better acceptance in research and policy circles in India (MoWR, 2007).

The key question is whether or not technology options will be the best solution to address future water demand scenarios. This is because, in spite of the introduction of several water management technologies by the research centres, the existing water use efficiency is still low at farm level and national level studies on the evaluation of the water management technologies are also not available (Palanisami *et al.*, 2012). Such an exercise will not only help improve the existing performance of the water management/research institutes, but also give direction for designing future water management research and outreach programs.

Water management technologies from research centres – are they financially viable?

The analysis of data relating to different water management technologies/practices basically relied on two important indicators *viz.*, Benefit-Cost Ratio (BCR) and Internal Rate of Return (IRR). The BCR implies the returns derived per rupee of investment, while the IRR implies the rate at which the technology gives back the return. Overall, the IRR varied from 10% for improved water management for banana in Orissa and for wheat in West Bengal to 54% for drip fertigation method for onion in Maharashtra indicating the sensitiveness of the technologies among the

regions. The average rate of return was about 21%. For instance, for the SRI - rice crop in Bhavanisagar Centre, Tamil Nadu, the BCR worked out to 1.06 and IRR to 17%. It clearly indicates that every one rupee investment on SRI research generated Rs. 1.06. As the BCR is greater that one, one can conclude that the SRI is a viable technology. Similarly, the IRR is 17%, which is greater than the opportunity cost of capital. These results suggest that the particular technology is financially viable.

Water management technologies- are they fully adoptable by farmers?

Due to the FPARP interventions, there was an increase in water saving at farm level in various crops ranging from 8% for mixed cropping in vegetables in Orissa to 27.53% for Integrated Nutrition Management (INM) in rice in Assam. Likewise considerable proportion of water savings under FPARP was recorded in Apple (18.72%) due to water harvesting tanks and pipe line water supply, drip with gravity fed micro irrigation and black plastic mulching. Number of farmers in several regions had also reported the reduction in number of irrigations (ranging from 0 to 13.5%) which was mainly due to the awareness created by the FPARP on effective irrigation practices. On the whole, average water saving reported by farmers due to the water management technologies was about 15%, which is about half of the water saving reported in the experimental station based technologies. In all the regions and crops, yield increase ranged from 2.3% in wheat INM in Jharkhand to 18.3% in apple in Jammu and Kashmir. Looking at all the regions and crops, the average yield increase was about 10%, which is about 38% of the yield increase reported under research station based technologies. The financial rate of return of the technologies/practices adopted by the farmers under FPARP is comparatively low (most of them were in the range of 6 - 18% with an average IRR of 10.8%) showing the poor performance of these technologies under varied agro-climatic and socio-economic conditions of the farmers.

In sum, only 110 technologies/practices from the research stations were adopted in the farmers' fields. This accounts for about 22% of the technologies/ practices released by the research stations and 28% of the 402 technologies/practices covered under the FPARP. Among the technologies that were successfully transferred, micro irrigation (drip and sprinkler) had the major share (65%) compared to gravity based surface irrigation technologies. Given the poor adoption rate of the research station technologies by farmers (22%) and their poor financial returns (only 55% of them had a financial rate of return of more than 10%), the success rate of the water management technologies is only about 12% (*i.e.*, 22*0.55). Among the regions, the percent gap in water saving between research stations and farmers fields was comparatively lower (32%) in southern region, while the percent gap in yield was lower in northern region (48%) (see Table 1).

Constraints in adopting the technology

The major constraints faced by the farmers besides timely water supplies, in adopting the technological interventions were high capital or initial cost of some of the technologies like drip and sprinkler. More than 30 per cent of the farmers had responded for the high initial cost except in case of Rajasthan and West Bengal. The other major constraints faced by the farmers were lack of labour supply followed by lack of technical skills and assured water release to adopt the recommended technologies.

Recommendations

Currently, the water management research centres give more focus (80-90%) in continuing more or less same type of research/experiments for the same set of crops and less attention is given for outreach activities. Hence, given the vast number of technologies available with the research institutions in each region, water management research centres should give more emphasis on technology transfer to farmers than technology development.

Table 1. Comparison of research station and farmer based technologies in different regions

Regions	Increase in water saving (%)		Gap (%)	Increase in yield (%)		Gap (%)	Internal rate of return (%)		Gap (%)
	Research station	FPARP		Research station	FPARP		Research station	FPARP	
Southern	26.58	18.12	31.84	24.75	8.03	67.54	22.25	10.44	53.06
Western	38.34	11.98	68.75	24.63	10.79	56.21	25.00	10.86	56.57
Northern	30.95	12.23	60.49	20.86	10.72	48.60	19.08	11.44	40.01
Eastern	29.40	15.29	48.00	19.93	8.60	56.85	15.50	9.25	40.32
North Eastern	42.50	27.53	35.22	80.33	12.80	84.07	17.00	14.00	17.65
Average	32.73	14.85	54.61	26.21	9.72	62.92	20.96	10.8	48.48

(a) Once a technology is proven in the research stations, farmers' participatory action research can be conducted in a cluster of 5-6 villages continuously for 2-3 years. It should be made clear that no water management research/practice can go beyond 4-5 years in one location without proper outreach activities.

(b) As still 78% of the practices in the farmers' fields are local wisdom based, future research should take the lead from these practices and validate them (bottom up approach). Technology audit should be made mandatory for all research centres to include demand driven research agenda.

(c) Capacity building programs on these technologies can be inbuilt in the extension programs of the research stations and state agriculture departments in each region. Wherever possible, public-private partnership in technology promotion and uptake such as drip and sprinkler irrigation can be explored by initiating local skill development programs involving the drip manufacturers and suppliers.

The views expressed in this paper are of the author only and they do not necessarily reflect those of the organization he belongs to or the Academy.

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Fellows Views

Authenticity and originality are among the important criteria that lend credibility to the scientific publication. In the race to increase the number of publications, there has been a remarkable rise in the last one decade in the number of books and journals being published in agricultural sciences. The sole purpose of a large number of such publications is making profit out of papers. Neither there is a competent editorial body to ensure scientific standards, nor any accountability of the publishers with respect to the authenticity of the publication. Many of these survive on plagiarised contents without any checks. As the responsible fellows of the Academy, which stands for credible science, we must fight this menace and not allow or accept any unethical practice in agriculture publication, wherever possible. Plagiarism has taken several forms. One, which some authors think quite acceptable, is self-plagiarism, meaning publishing the same text, results, chapters and reviews in different publications under different titles in which one of the authors (the one who actually indulges into it) remains common.

I suggest that NAAS makes it compulsory that all scientific journals scored by it have an in-built anti-plagiarism mechanism (such as using a software or taking an undertaking from all contributing authors, etc.) and every fellow of the Academy must take a pledge at the time of induction that she/he will refrain from and resent any form of plagiarism or malpractice in science.

Malavika Dadlani
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The recommendations emerging from the National Agricultural Research System (NARS) on appropriate agronomic practices from time to time have helped in increased organic carbon (OC) sequestration in all soil types without leading to increased emissions of greenhouse gases (GHGs) to any alarming proportion. This, however, is linked to the following important pedo-chemical reactions, which hitherto were not given due importance in simulation model exercises. These are (i) the formation of pedogenic calcium carbonate by sequestering atmospheric CO_2 in SAT soils, (ii) increased OC sequestration in rice fields under submergence, (iii) maintenance of higher amount of soil C in passive pools in rice fields and protection of OC by preventing its oxidative losses to gaseous C loading into the atmosphere, (iv) application of moderate amount of N fertilizers and FYM, and (v) protection of $NH4^+$ produced through the addition of inorganic fertilizers and FYM on zeolite exchange sites of shrink-swell soils from microbial conversion of $NH4^+$ to NO_3. Thus a new research initiative is warranted to make future projections on the GHGs emissions by simulation and modelling amidst the scenario of positive OC balance.

D.K. Pal
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The views expressed above are of the Fellows only and they do not necessarily reflect those of the Academy.

Awards and Honours

Professor Ramesh Chand

Agriculture expert Professor Ramesh Chand, NAAS Fellow and former Director, ICAR National Institute of Agricultural Economics and Policy Research, New Delhi has been appointed full-time member of the National Institute of Transforming India – "NITI Aayog" by the Government of India. Prof. Chand is among the three full time members of the NITI Aayog, which is expected to submit its policy recommendations to the Prime Minister soon. The appointment of Prof. Chand to NITI Aayog would help to set in motion required policy changes in mitigating agrarian distress and boost farm incomes. The entire NAAS Fellowship extends warm congratulations to Prof. Chand on assuming the new responsibility in NITI Aayog.

Dr. B. Venkateswarlu

Dr. B. Venkateswarlu, Vice-Chancellor, VNMKV, Parbhani and fellow of the Academy was awarded the Vasantrao Naik Krishi Puraskar 2015 for his work on promoting water conservation technologies in Marathwada region. The award is given by the Chief Minister of Maharashtra and sponsored by Vasantrao Naik Pratisthan, Mumbai in the memory of Late Chief Minister of Maharashtra. Dr. Venkateswarlu also shared this year's Hari Om Ashram trust award of ICAR along with Dr. Ch. Srinivasa Rao for his work on soil carbon sequestration in relation to climate change in India. It is a matter of pride for the Academy that its distinguished Fellow has been awarded for his outstanding research contributions.

Dr. R.K. Singh

It is a matter of great honour for the Academy that Dr. R.K. Singh, Former Vice-President, NAAS was awarded the prestigious literary award – "Sahitya Bhusan" for his distinguished literary works in Hindi in the form of story books, poetries, essays on socio-economic and agriculture issues, besides his own auto-biography in two parts, which has been widely acclaimed and recognized by the Hindi Journals – "Shabdita," fully devoted to pure literary work, and "Nand Prasar Jayoti," devoted to rural farmers. Dr. Singh also runs a programme called "Kavita Gaon ki Oar (taking poetry to the rural areas)" – the aim of which is to create socio-cultural awakening among the masses, especially the rural youth. Dr. Singh received this award on 14 September 2015 from the Chief Minister of UP.

Forthcoming Programme

- Brainstorming session on 'Organic Farming' to be held on October 17, 2015 (Convener: Dr. B.S. Dwivedi and Co-conveners: Dr. P.K. Chhonkar and Dr. R.K. Pathak).

Change in Addresses

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Obituary

1925-2015

Dr. Taracad Narayanan Ananthakrishnan, renowned Zoologist, one of world's leading entomologist and a man with great human qualities passed away on the 7th August, 2015 in USA. He was born in 1925 in Taracad, Palghat in Mangalore. He graduated in the year 1946 from the Madras Christian College and was appointed a lecturer in the same college for two years from 1946-48. But he soon shifted to the Loyola College, Madras and he started the Department of Zoology, and also obtained his M.Sc. degree by research from the Madras University in 1954. He carried on with his research work on Thysanoptern insects called thrips very actively with dedication and devotion. The hard work paid rich dividends and he was successful in being awarded the Ph.D. and D.Sc. degrees from the Madras University in the years 1961 and 1967, respectively. He steadily organized his research work on thrips in a systematic manner and with great far sight in view of the economic importance of these insects in agriculture.

He was a blessed orator, a quality which made him an outstanding teacher with innate skills to teach effectively and inspirationally. He was also an extraordinary and prolific writer. He possessed unique qualities of passion, perseverance, commitment and hard work.

Dr. Ananthakrishnan was appointed to the post of Director, Zoological Survey of India, in May 1977. Though he stayed at ZSI only for three years, he brought about far reaching and very positive changes in the administrative as well as scientific work. While at ZSI, Dr. Ananthakrishnan impressed upon scientists to undertake research on ecology and biology apart from mandated taxonomic studies. In view of this, he started five new stations of ZSI so as to fulfil these aims and the objectives. In 1980, he received the Jawaharlal Nehru Fellowship and resigned from ZSI. He retuned back to Loyola College in Madras and established Entomology Research Institute the same year and continued his work largely on the chemical and molecular ecology of insect-plant interactions.

For his dedicated work he was decorated with ICAR Rafi Ahmed Kidwai Memorial Award, 1972; Ministry of Environment Pitambar Pant Award, 1986; Dr. K.C. Mehta Memorial Award 1997-98; INSA Sundarlal Hora Medal, 1999; ISCA J.C. Bose Award, 2000; Indian Ecological Society, 1998; Monsanto Lifetime Achievement Award, 2002; INSA Golden Jubilee Award, 2009.

During the past 35 years I had known Dr. Ananthakrishnan very closely. We had several occasions to meet. He always eulogized my work and would give advice for my research work, and in my career, etc. Incidentally, I was also appointed Director ZSI in the year 1988 and joined the survey on 20th February, 1989. The last remark that I will make about him is that TNA was a man of grit and great determination. He was also member of Executive Council of NAAS during October 1992 till December 1999. Fellowship mourns the sad demise of one the distinguished fellows of Academy and pays its homage to the departed soul.

(**Prof. M. Shamim Jairajpuri**,
Former Director, ZSI) and (Editors, NAAS)

Announcement

The Academy jointly with ICAR and IARI will be celebrating the Golden Jubilee of Green Revolution in India on November 27, 2015 at B.P. Pal Auditorium, IARI, Pusa, New Delhi. On this occasion Director General IRRI will be the guest of honour. Prof. M.S. Swaminathan, the father of Green Revolution, will be the key speaker. The organizers will felicitate prominent persons, including a farmer, who were involved in spearheading the Green Revolution movement in the country and listen to their impressions on Green Revolution. Dr. S. Ayyappan, Secretary DARE, DG ICAR and President NAAS, will share the Vision-2050 of ICAR with honourable participants at this important event. Shri Radha Mohan Singh, Hon'ble Minister for Agriculture, GOI will grace the event as Chief Guest.

Editors: Dr. K.K. Vass & Prof. V.K. Gupta

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